

# Summary of Primary and Secondary Lines of Evidence for Red Hill Groundwater Chemistry – Navy Evaluation

## 1. No evidence of nearby LNAPL in outlying wells

### Primary LOE:

1a. Naphthalene dry wells not good indicator of presence of LNAPL

### Secondary LOEs:

1. Specific detections  
2. Very low detection with susceptibility to interference artifacts and extremely more variable  
3. Detections do not often coincide with 1- and 2- naphthol detections or TPH detections

1b. Electron acceptors not depleted

1. Good secondary proxy

1c. Metabolic byproducts not detected

1. Methane not detected  
2. Ferrous not used consistently non-detect

1d. No consistent detections of COWs and nonCOWs with naphthalene

1. BTEX not detected in most outlying wells  
2. NonCOWs were detected, detected infrequently  
3. NonCOWs detections in outlying wells rarely compounds not associated with fuel  
4. NonCOWs that can be present in fuel detected infrequently in outlying wells

1e. TPH should be assessed in context of other COWs and nonCOWs

1. Detections often did not coincide with detections of other COWs  
2. TPH a parameter affected by the method used  
3. Results can include hydrocarbons, metabolites, and anything present detectable by the method  
4. Absolute values should be interpreted with caution  
5. A detection is not a direct indication of hydrocarbons in GW

1f. TICs not good indicator of presence of LNAPL

1. TIC identification and concentrations cannot be confirmed with comparison to known standard  
2. Majority of detections not associated with fuel  
3. Hydrocarbon detections not indicative of a fuel release

1g. Lead scavengers not detected

1. EPA recommend evaluation of Pb scavengers  
2. 1,2-DCA used in fuel gasolene (not aviation gasoline). Detections of 1,2-DCA in RH-MW2 only from other fuels/gases or POC, mostly other than fuel gasolene  
3. Based on discolored analytes, no evidence of a recent fuel release

### 1a. No evidence of impact to other outlying wells from 2014 release:

1b. Continued sporadic BTEX detections with no apparent increase in detection frequency after 2014 fuel release

1. Apparent decrease in detection frequency in outlying wells after Oct 2012 to Oct 2014 with reference to same proper detecting naphthalene

1c. Continued sporadic naphthalene detections with no apparent increase in detection frequency after 2014 fuel release

1. Apparent decrease in detection frequency in outlying wells after Oct 2012 to Oct 2014 with reference to same proper detecting naphthalene

## 2. No evidence of LNAPL nearby Red Hill Shaft

### Primary LOE:

2a. Naphthalene dry wells not a good indicator of presence of LNAPL near Red Hill Shaft

### Secondary LOEs:

1. Specific detections  
2. Very low detection with susceptibility to interference artifacts and extremely more variable  
3. Detections do not often coincide with 1- and 2- naphthol detections or TPH detections

2b. Electron acceptors not depleted at Red Hill Shaft

1. Data conditions present  
2. Nitrate not depleted  
3. Sulfate not depleted  
4. Reducing conditions not present

2c. Metabolic byproducts not detected in Red Hill Shaft

1. Methane not detected since Oct 2016  
2. Ferrous not used consistently non-detect since Oct 2016

2d. No consistent detections of COWs and nonCOWs with naphthalene

1. BTEX detected in two samples, not confirmed during subsequent sampling events  
2. NonCOW detections rarely compounds not associated with fuel  
3. Only one detection (Oct 2016) of nonCOWs related to fuel, non-petroleum PMA

2e. TPH should be assessed in context of other COWs and nonCOWs

1. Detections often not coincident with detections of other COWs  
2. TPH a parameter affected by the method used  
3. Results can include hydrocarbons, metabolites, and anything present detectable by the method  
4. Absolute values should be interpreted with caution  
5. A detection is not a direct indication of hydrocarbons in GW

2f. TICs not good indicator of presence of LNAPL

1. TIC identification and concentrations cannot be confirmed with comparison to known standard  
2. Majority of detections not associated with fuel  
3. BTEX detections expected to be found with other hydrocarbons if coming from a fuel leak

2g. Lead scavengers not detected in Red Hill Shaft

1. EPA recommend evaluation of Pb scavengers  
2. 1,2-DCA used in fuel gasolene (not aviation gasoline). Detections of 1,2-DCA in RH-MW2 only from other fuels/gases or POC, mostly other than fuel gasolene  
3. Based on discolored analytes, no evidence of a recent fuel release

## 3. No evidence of GW impact from 2014 fuel release

### Primary LOE:

3a. No change in BTEX detections in RH-MW2 after 2014 fuel release

### Secondary LOEs:

1. Fresh source of LNAPL in RH-MW2 vicinity would change the ratio as fresh fuel has a different signature than degraded fuel

3b. Ratio of methylphenols to naphthalene in RH-MW2 did not change after 2014 fuel release

1. TPH signal is obscured in context of other COWs and nonCOWs

3c. TPH does not good indicator of changes in water chemistry in RH-MW2 after 2014 release

1. Results can include hydrocarbons, metabolites, and anything present detectable by the method  
2. Comprehensive evidence of TPH concentrations at compounds can be determined by using toxic gas cleanup  
3. Polar compounds more soluble than parent, non-petroleum hydrocarbons can result in increased solubility of what is measured as TPH  
4. Polar compounds tend to be in RH-MW2 more soluble than parent hydrocarbons, what is measured as TPH not indicative of presence of LNAPL, but the increase is indicative of an older nearby source

3d. Measured TPH concentrations in RH-MW2 not good indicator of presence of LNAPL

1. Increased frequency of detections after 2014 release, reflective of increased sampling events, not change in GW chemistry

3e. No change in COW detection signature in RH-MW2 after 2014 fuel release

1. TIC identification and concentrations cannot be confirmed with comparison to known standard  
2. Majority of detections not associated with fuel  
3. Hydrocarbon detections not indicative of a fuel release

3f. No lead scavengers measured in RH-MW2 before or after 2014 fuel release

1. EPA recommend evaluation of Pb scavengers  
2. 1,2-DCA used in fuel gasolene (not aviation gasoline). Detections of 1,2-DCA in RH-MW2 only from other fuels/gases or POC, mostly other than fuel gasolene  
3. Based on discolored analytes, no evidence of a recent fuel release

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